IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Gary A. Demos	Art Unit	: 2613
Serial No.	: 09/905,039	Examiner	: Y. Young Lee
Filed	: July 12, 2001		
Title	: METHOD AND SYSTEM FOR IMPROVING COMPRESSED IMAGE CHROMA INFORMATION		

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Commissioner for Patents
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BRIEF ON APPEAL

Sir:

Applicant herewith files this brief on appeal under 37 CFR 41.37, thereby perfecting the notice of appeal which was originally filed on June 16, 2006.

The sections required by 37 CFR 41.37 follow.

(1) Real Party in Interest

This application is assigned of record to Dolby Laboratories Licensing Corporation who is hence the real party in interest.

(2) Related Appeals and Interferences

There are no known related appeals or interferences.

(3) Status of Claims

Claims 8-15, 37-44, 66-73, and 88-90 are pending, with claims 8-10, 12-14, 37-39, 41-43, 66-68, and 70-72 being independent. All of these claims are appealed herein.

(4) Status of Amendments

No claim amendments have been filed after final rejection of February 16, 2006.

(5) Summary of Claimed Subject Matter

The described and claimed subject matter involves techniques for reducing chroma noise and techniques for achieving higher compression.

Independent claim 8, recites a method for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression (see e.g., specification: page 8, paragraph 18; page 13, paragraph 39; page 14, paragraphs 40-41; page 15, paragraphs 42-48; page 16, paragraphs 49-50). The method includes utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in the QP corresponds to a larger quantization step size (see e.g., specification: pages 13-14, paragraph 39; co-pending U.S. Patent Application 09/798,346, entitled "High Precision Encoding and Decoding of Video Images," which is incorporated by reference describes QP on page 5, lines 12-13; page 14, lines 11-31; page 16, lines 15-21). The method involves utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock, and utilizing a second QP value for at least one of U and V color channels of the color video image for the first macroblock (see e.g., specification: pages 13-14, paragraph 39; page 14, paragraphs 40-41; page 15, paragraph 42). The second QP value is dependent only upon a relationship to the first QP value, where the relationship includes a property that the second QP value for

the first macroblock is lower than the first QP value so that at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for that macroblock.

Independent claim 9 includes features similar to claim 8. In addition to claim 8's features noted above, claim 9 further includes features such that the second QP value is determined by applying a bias value to the first QP value for the relationship (see e.g., specification: page 14; paragraph 41; page 15, paragraphs 43-48; Fig. 2; page 16; paragraphs 49-50).

Independent claim 10 includes features similar to claim 8. In addition to claim 8 features, claim 10 further includes features for applying the first and second QP values, and compressing the color video image, after application of the first and second QP values, to a compressed output image (see e.g., specification: pages 13-14, paragraph 14; page 14, paragraph 40; page 15, paragraphs 42-48; Fig. 2; page 16, paragraphs 49-50).

Independent claim 12 recites a method where, in a YUV video image compression system that utilizes macroblocks and quantization parameters during compression, a variable quantization step size and a quantization parameter (QP) represents a size of a step, for which an increase in QP corresponds to a larger quantization step size (see e.g., specification: page 8, paragraph 18; page 13, paragraph 39; page 14, paragraphs 40-41; page 15, paragraphs 42-48; page 16, paragraphs 49-50; co-pending U.S. Patent Application 09/798,346, entitled "High Precision Encoding and Decoding of Video Images," which is incorporated by reference describes QP on page 5, lines 12-13; page 14, lines 11-31; page 16, lines 15-21). The method includes selecting at least one of reducing chroma noise during

compression of a color video image and achieving higher compression during compression of the color video image.

In response to selecting reducing chroma noise in claim 12, the method recites techniques similar to claim 8. Hence, method involves utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock, and utilizing a second QP value for at least one of U and V color channels of the color video image for the first macroblock (see e.g., specification: pages 13-14, paragraph 39; page 14, paragraphs 40-41; page 15, paragraph 42). The second QP value is dependent only upon a first relationship to the first QP value, where the first relationship includes a property that the second QP value for the first macroblock is lower than the first QP value so that at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for the first macroblock. The finer quantization resolution for color has the effect of reducing the chroma noise.

In response to selecting to achieve higher compression in claim 12, the method involves utilizing the first QP value for the Y luminance channel of the first macroblock of the color video image, and utilizing the second QP value for at least one of the U and V color channels of the first macroblock of the color video image (see e.g., specification: page 15, paragraphs 43-48; Fig. 2; page 16, paragraphs 49-50). The second QP value is dependent only upon a second relationship to the first QP value. The second relationship includes a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for the first macroblock (see e.g., specification: page 9, paragraph 19;

page 15, paragraphs 43-48; Fig. 2; page 16, paragraphs 49-50). The coarser quantization resolution for color reduces the number of bits required to encode the color channels, and hence also increases the compression ratio.

Independent claim 13 includes features similar to claim 12's. In addition to claim 12 features, claim 13 further includes features such that for at least one of the relationships, the second QP value is determined by applying a bias value to the first QP value (see e.g., specification: page 8, paragraph 18; page 9, paragraph 19; Fig. 2; page 15, paragraphs 42-48; page 16, paragraphs 49-51).

Independent claim 14 includes features similar to claim 12's. In addition to claim 12 features, claim 14 further includes applying the first and second QP values, and compressing the color video image, after application of the first and second QP values, to a compressed output image (see e.g., specification: pages 13-14, paragraph 39; Fig. 2; paragraphs 44-48. Also, see co-pending U.S. Patent Application 09/798,346, entitled "High Precision Encoding and Decoding of Video Images": page 5, lines 12-18; page 15, lines 14-30; page 16, lines 1-21; page 17, lines 22-31; Fig. 5).

Dependent claim 15 depends upon claim 14. Claim 15 includes features for decompressing the compressed output image using the first and second QP values to obtain an uncompressed video image (see e.g., specification: Fig. 2, page 16, paragraphs 49-50).

Independent claim 37 is a claim for a computer program stored on a computer-readable medium that includes instructions operative to cause a computer to perform features similar to method claim 8 as described above. Independent claim 38 is a

claim for a computer program stored on a computer-readable medium that has features similar to method claim 9. Independent claim 39 is a claim for a computer program stored on a computer-readable medium that has features similar to method claim 10. Dependent claim 40 depends upon claim 39, and claim 40 has features similar to dependent claim 11. Independent claim 41 is claim for a computer program stored on a computer-readable medium that has features similar to method claim 12. Independent claim 42 is claim for a computer program stored on a computer-readable medium that has features similar to method claim 13. Independent claim 43 is claim for a computer program stored on a computer-readable medium that has features similar to method claim 14. Dependent claim 44 depends upon claim 43, and claim 44 has features similar to dependent claim 15.

Independent claim 66 is a claim for a system that has features that are similar to method claim 8, including features for applying the first and second QP values during compression of the color video image. Independent claim 67 is a claim for a system that has features that are similar to method claim 9, including features for applying the first and second QP values during compression of the color video image. Independent claim 68 is a claim for a system that has features that are similar to method claim 10. Dependent claim 69 depends upon claim 68, and claim 69 has features similar to claim 11. Independent claim 70 is a claim for a system that has features that are similar to claim 12, including features for applying the first and second QP values during compression of the color video image. Independent claim 71 is a claim for a system that has features that are similar to claim 13, including features for applying the first and second QP values during compression of the color

video image. Independent claim 72 is a claim for a system that has features that are similar to claim 14, including features for applying the first and second QP values during compression of the color video image. Dependent claim 73 depends upon claim 72, and claim 73 has features similar to claim 11.

(6) Grounds of Rejection to be Reviewed on Appeal

Claims 8-15, 37-44, 66-73 and 88-90 stand rejected under 35 U.S.C. 102(b) as allegedly being anticipated by Naimpally et al. (U.S. Pat. No. 5,294,974).

(7) Argument

Lossy video codecs use quantization to control the trade-off between visual fidelity and the degree of compression. This trade-off is that the larger the degree of compression, the lower the visual fidelity.

For all codecs of any significance, the degree of quantization is controlled by a *quantization parameter*, QP. QP is simply a parameter from which the *quantization step-size*, QS, is derived. The quantized representation is then just the quotient of the value to be quantized, X, and the quantization step-size QS. That is, Quantized value = X/QS (this quotient may or may not be rounded).

Often the quantization step-size QS, is the same as the quantization parameter, QP (for example, MPEG-2 with q_scale_type = 0). Alternatively, the values of QS may be distributed exponentially (for example, MPEG-2 with q_scale_type = 1 or H.264). By convention, a larger value of QP corresponds to (that is, determines) a larger value of QS which results in a coarser quantization which produces fewer coded bits but poorer

visual fidelity or quality. Conversely, a smaller value for QP always results in a smaller (finer) quantization step-size, and hence more coded bits and higher visual quality.

The *quantization resolution* is the inverse of the quantization step-size QS and hence varies inversely to the quantization parameter QP. Thus the higher the quantization resolution the lower QS (and QP) will be, and vice-versa.

The human visual system is less sensitive to color (or chroma) than luminance (or luma). The perceivable spatial resolution of color is roughly half that of luminance because of the relative distribution of rods and cones on the retina. This is the justification behind the common 4:2:0 video format, in which the spatial resolution of color is half that of luminance in both the horizontal and vertical directions. However, when the displayed resolution (in arc seconds) of the image is not at the limit of luminance resolution, this relationship is no longer true and chroma artifacts become visible. These effects are typically referred to using the term *chroma noise*.

<u>Claims 8-15, 37-44, 66-73</u>

1.) Naimpally does not disclose all of the features of the claims.

Naimpally does not disclose features recited in Claims 8-10, 12-14, 37-39, 41-43, 66-68, and 70-72. Claims 8-10, 37-39, 66-68 require **(a) "the second QP value is dependent <u>only</u> upon a relationship to the first QP value,"** **(b)** "wherein the relationship comprises a property that the second QP value for said first macroblock is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said

first macroblock," and **(c)** where the first QP value is for the Y luminance channel and the second QP value is for at least one of the U and V color channels in the macroblock (emphasis added and supported on pages 13-15, paragraphs 39-42 of specification). Claims 12-14, 41-43, and 70-72 recite these features in "a first relationship." Instead, Naimpally teaches that the second QP values **are a function of other types of relationships**, and not only a relationship to the first QP value as recited in Claims 8-10, 12-14, 37-39, 41-43, 66-68, and 70-72. Naimpally does not disclose this feature. For example, Naimpally teaches the following types of relationships.

A.) Naimpally discloses two conditions to vary the QP values of the luminance and/or chrominance blocks. **Neither of Naimpally's conditions are based on the relationship as recited in the claims.**

In a first condition, if Naimpally does not detect chrominance blocks of near-red pixel values, then Naimpally discloses using the default prior art system of Fig. 1 **where the quantization step size remains the same for both the luminance and chrominance blocks** (Naimpally: Fig. 1, Col. 5, lines 13-24 describe the problems with the quantization of Fig. 1). Since the same quantization step size is used for the luminance and chrominance blocks of pixel values, then above-recited feature of "the second QP value for said first macroblock is lower than the first QP value" is not disclosed for the prior art (Fig. 1) condition.

In a second condition, **Naimpally looks to other things besides the above-recited relationship** in the claims to

adjust quantization for the luminance and/or chrominance blocks. For example, Naimpally discloses that the QP values of the chrominance blocks ((B-Y), (R-Y)) of pixel values are **dependent upon a function of detecting a red or near-red color that is saturated or nearly saturated in a macroblock** (herein "near-red color") (Naimpally: Col. 1, lines 5-12; Col. 2, lines 16-25; Col. 5, lines 47-50; Col. 6, lines 58-68; Col. 7, lines 1-6). So if a near-red color is detected in the chrominance blocks by Naimpally's circuitry (Fig. 2, 6), then Naimpally discloses adjusting the QP values of the chrominance blocks so that finer quantization steps are used for the chrominance blocks. Therefore, these QP values are not based only on a relationship to another QP value as claimed. Rather they are based on the color (e.g., the "near red-color").

In the description of the second condition, Naimpally states that Fig. 2 is a block diagram of a video encoding system and is the prior art video encoding system Fig. 1 with new circuit blocks added for the color average circuit 208, the color detector circuit 210, and the quantization modifier circuit 212 (Naimpally: Col. 2, lines 31-35, 59-60; Col. 5, lines 29-35). The color average circuit 208 receives a signal from a block converter 110, averages the sixty-four pixel values in each of the (B-Y) and (R-Y) blocks in the macroblock, and those two average values are sent to the color detector 210 (Naimpally: Col. 5, lines 30-62). Fig. 6 shows an exemplary color detector circuit 210 (Naimpally: Col. 5, lines 63-68, Col. 6, lines 1-28). Naimpally states that the color detector circuitry 210 is for detecting chrominance blocks of near-red color pixel

values (Naimpally: Col. 5: lines 35-46; Figs. 5, 6). Naimpally discloses that the color detector circuit 210 then conditions the modifier 212 to adjust the quantization step size for the near-red blocks of pixels for (B-Y) and (R-Y) (Naimpally: Col. 5, lines 35-68). In particular, if the color detector circuitry 210 detects chrominance blocks of pixel values in that color and saturation range, then the modifier circuit 212 and the quantizer-control circuitry 122 changes the quantization step size of those chrominance blocks "using finer quantization steps than would normally be used" (Naimpally: Col. 5, lines 42-47).

The rejection also specifically refers to Col. 6, lines 28-36 of Naimpally, which discloses that the quantization resolution of both the luminance and chrominance blocks of pixels are increased as a function of detecting a saturated near-red color in a macroblock (Naimpally: Col. 6, lines 28-34). Increasing the quantization resolution reduces the QP value. Naimpally also discloses that the QP values for the chrominance blocks alone are modified in response to the detection of a saturated near-red color in a macroblock (Naimpally: Col. 6, lines 34-36). Therefore, regardless of whether the QP values of both the chrominance and luminance blocks of pixels are changed together or the QP values of the chrominance blocks of pixels are changed alone, Naimpally discloses that changes to the QP values of the chrominance blocks of pixels are a function of detecting a red or near-red color that is saturated or nearly saturated in a macroblock.

Hence, Naimpally discloses that (1) the QP values of the chrominance blocks of pixel values are **dependent upon a**

function of color and saturation, and (2) the chrominance blocks of pixel values are adjusted for finer quantization steps **for the near-red color pixel values**. Naimpally fails to disclose the claimed feature of "the second QP value is **dependent only upon a relationship** to the first QP value," and instead looks to other things (e.g., color) besides the above-recited relationship in the claims to adjust quantization for the luminance and/or chrominance blocks.

Therefore, there is a factual deficiency in the 02/16/2006 Office Action, and the rejection under 35 U.S.C. 102(b) to Claims 8-10, 12-14, 37-39, 41-43, 66-68, and 70-72 does not meet the Patent Office's burden of showing a prima facie showing of unpatentability, and should be reversed.

B.) QP values in Naimpally depend upon an average of the chroma pixel values.

Naimpally discloses that the **QP values are dependent upon an average of the (B-Y) and (R-Y) sample or pixel values** in a macroblock (Naimpally: Col. 5, lines 65-68; Fig. 6; Tables 1-3 show relationships using average chrominance blocks; Fig. 6 shows average input chrominance blocks from color average circuit 208 as inputs to the ROM 210). The chrominance QP values are not dependent only upon the luminance QP values in Naimpally. Therefore, the claims are further patentable for at least this reason.

C.) QP values in Naimpally are dependent upon a quantization divider.

Naimpally discloses that the **QP values are dependent upon a quantization divider** (quantizer circuitry 122) to multiply QP values "by factors ranging from one-quarter to two in steps of one-quarter," **where the factors for multiplication depend upon the average QP values and the color and saturation** (Naimpally: Col. 6, lines 25-28; Col. 7, lines 22-60; and Tables 1-3 show the "quantization divider" multiplication factors and corresponding functions for AVG (B-Y) and AVG (R-Y)). Naimpally's chrominance QP values are not dependent <u>only</u> upon the luminance QP values. Hence, the rejection under 35 U.S.C. 102(b) to the claims should be withdrawn.

2.) Naimpally is silent about disclosing the selection of achieving higher compression as recited in Claims 12-14, 41-43, 70-72.

A.) Naimpally treats high-quality compression the same as low-quality compression.

An effect of the claimed system is that Naimpally does not allow for the different treatment of cases where the QP values are small from those cases where the QP values are large. Naimpally treats high-quality compression the same as low-quality compression, regardless of the multiplication factor for the QP values (Naimpally: Col. 6, lines 25-28; Tables 1-3). However, the current application allows high-quality compression to be treated differently from low-quality compression and recites techniques for different treatment via the relationship between the first and second quantization values (*e.g.*, see the "selecting" language in Claims 12, 13,

14, 41, 42, 43, 70, 71, and 72). Hence, this is another patentable distinction over Naimpally.

B.) Naimpally discloses a different and inflexible approach for the claimed subject matter in the specification.

Naimpally discloses a system to reduce a number of bits for encoding data that is fixed and a only a function of hue (*e.g.*, Naimpally: Tables 1-3 are a function of hue). For example, Naimpally does not give an operator of an encoder any flexibility with regard to the issue of color fidelity versus compression ratio (*e.g.*, Naimpally: encoding system of Fig. 2 and related description). Naimpally discloses fixed rules to modify quantization as a function of hues that are near-red. With Naimpally, the only options available to the operator of the encoder are to accept or reject the disclosed rules-based scheme.

In contrast, the current application teaches and claims a more flexible and realistic approach than Naimpally. With the current application, the operator can decide, on a case by case basis, how best to balance reduced chroma noise and increased compression. For example, the operator can decide by determining whether chroma QP is larger or smaller than luminance QP, as in Claims 12-14, 41-43, 70-72. Furthermore, the current application permits the operator to decide how to control a magnitude of the effect of the balancing (*e.g.*, how much of a difference there is between chroma and luminance QPs) either through bias values or different tables (*e.g.*, specification: pages 14-16, paragraphs 41-44, 51; Claims 13, 42, 71, 88-90). Hence, there are at least two additional

reasons why Naimpally does not anticipate each and every claimed feature of the current application.

Thus, not only are Naimpally and the current application different inventions, Naimpally and the current application disagree as to the nature of the problem to be solved. For instance, Naimpally provides a solution for reducing a number of bits for encoding data as a fixed, universal function of hue. However, Claims 12-14, 41-43, 70-72 of the current application provide a solution for reducing chroma noise and achieving higher compression, where the solution involves both the content of the data (*e.g.*, differences between chroma and luminance QPs) and the overall goals (*e.g.*, balancing reduced chroma noise and higher compression). Therefore, Claims 12-14, 41-43, 70-72 are clearly patentable over Naimpally.

For at least these reasons, the rejection does not meet the Patent Office's burden of providing a *prima facie* showing of unpatentability. Thus, Claims 8-10, 12-14, 37-39, 41-43, 66-68, and 70-72 are patentable over Naimpally for at least these reasons.

Claims 88-90

Claims 88-90 are patentable for at least depending upon an allowable base claim (e.g., base Claims 8 or 12 for Claim 88; base Claims 37 or 41 for Claim 89; and base Claims 66 or 70 for Claim 90), as well as for reciting patentable subject matter in their on right. The 02/16/2006 Office Action alleges that Naimpally discloses a look up table, and therefore, dependent Claims 88-90 are anticipated. As discussed above with respect

to Figs. 2 and 6, Naimpally fails to disclose the relationship as recited in the base claims. Instead, **Naimpally discloses in Tables 1-3 that the quantization step size is dependent upon (1) color and saturation, (2) an average of the (B-Y) and (R-Y) sample or pixel values in a macroblock, and (3) a quantization division factor** (Naimpally: Col. 6, lines 25-28, 37-44; Col. 7, lines 9-12, 23-25; see "AVG (B-Y)," "AVG (R-Y)," "Quantization divider" in Tables 1-3). Tables 1-3 show programs for the ROM 210 located at the input of the color detector circuit 210 of Fig. 6 that controls quantization based on color and saturation and an average of the input chrominance blocks of pixel values. Naimpally discloses in Tables 1-3 that the quantization step size ("Quantization divider") is dependent upon "red or near-red macroblocks" (Table 1), "near red signals which include some blue" (Table 2), "cyan and near-cyan objects and ... red and near red objects" (Table 3) (Naimpally: Col. 7, lines 61-68; Col. 8, lines 1-5). Dependent Claims 88-90 cannot be anticipated if Naimpally fails to disclose the feature of the relationship as recited in the respective base claims. Therefore, Claims 88-90 are patentable over Naimpally.

Conclusion

In view of the remarks herein, Applicant requests that the Board overturn the Examiner's rejection of all pending claims and hold that all of the claims of the present application are allowable.

The fee in the amount of $950 in payment for the appeal brief fee ($500) and the Petition for Extension of Time fee ($450) is being paid concurrently herewith on the Electronic Filing System (EFS) by way of Deposit Account authorization.

Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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Appendix of Claims

8. A method for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, including:

utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in the QP corresponds to a larger quantization step size;

utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock; and

utilizing a second QP value for at least one of U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, and wherein the relationship comprises a property that the second QP value for said first macroblock is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock.

9. A method for reducing chroma noise during compression of a color video image in a YUV video image compression system

using macroblocks and quantization parameters during compression, including:

utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in the QP corresponds to a larger quantization step size;

utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock; and

utilizing a second QP value for at least one of U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, wherein the relationship comprises a property that the second QP value for said first macroblock is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock, and

wherein for said relationship, the second QP value is determined by applying a bias value to the first QP value.

10. A method for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, including:

utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in the QP corresponds to a larger quantization step size;

utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock;

utilizing a second QP value for at least one of U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, and wherein the relationship comprises a property that the second QP value for said first macroblock is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock;

applying the first and second QP values; and

compressing the color video image, after application of the first and second QP values, to a compressed output image.

11. The method of claim 10, further including decompressing the compressed output image using the first and second QP values to obtain an uncompressed video image.

12. A method comprising:

in a YUV video image compression system, utilizing macroblocks and quantization parameters during compression, a variable quantization step size and a quantization parameter (QP) representing a size of a step, where an increase in QP corresponds to a larger quantization step size;

selecting at least one of reducing chroma noise during compression of a color video image and achieving higher compression during compression of the color video image;

in response to selecting reducing chroma noise,

utilizing a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilizing a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, and wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock; and in response to selecting achieving higher compression,

utilizing the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilizing the second QP value for said at least one of the U and V color channels of said first macroblock of the color video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, and wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock.

13. A method comprising:

in a YUV video image compression system, utilizing macroblocks and quantization parameters during compression, a variable quantization step size and a quantization parameter (QP) representing a size of a step, where an increase in QP corresponds to a larger quantization step size;

selecting at least one of reducing chroma noise during compression of a color video image and achieving higher compression during compression of the color video image;

in response to selecting reducing chroma noise,

utilizing a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilizing a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the

color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock; and

in response to selecting achieving higher compression,

utilizing the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilizing the second QP value for said at least one of the U and V color channels of said first macroblock of the color video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock, and

wherein for at least one of said relationships, the second QP value is determined by applying a bias value to the first QP value.

14. A method comprising:

in a YUV video image compression system, utilizing macroblocks and quantization parameters during compression, a

variable quantization step size and a quantization parameter (QP) representing a size of a step, where an increase in QP corresponds to a larger quantization step size;

selecting at least one of reducing chroma noise during compression of a color video image and achieving higher compression during compression of the color video image;

in response to selecting reducing chroma noise,

utilizing a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilizing a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, and wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock;

in response to selecting achieving higher compression,

utilizing the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilizing the second QP value for said at least one of the U and V color channels of said first macroblock of the color

video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, and wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock;

applying the first and second QP values; and

compressing the color video image, after application of the first and second QP values, to a compressed output image.

15. The method of claim 14, further including decompressing the compressed output image using the first and second QP values to obtain an uncompressed video image.

37. A computer program, stored on a computer-readable medium, for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, including utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in the QP corresponds to a larger quantization step size, the computer program comprising instructions for causing a computer to:

utilize a first QP value for a Y luminance channel of the color video image for a first macroblock; and

utilize a second QP value for at least one of U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, and wherein the relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock.

38. A computer program, stored on a computer-readable medium, for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, including utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in the QP corresponds to a larger quantization step size, the computer program comprising instructions for causing a computer to:

utilize a first QP value for a Y luminance channel of the color video image for a first macroblock; and

utilize a second QP value for at least one of U and V color channels of the color video image for said first macroblock,

wherein said second QP value is dependent only upon a relationship to the first QP value, wherein the relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock, and

wherein for said relationship, the second QP value is determined by applying a bias value to the first QP value.

39. A computer program, stored on a computer-readable medium, for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, including utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in the QP corresponds to a larger quantization step size, the computer program comprising instructions for causing a computer to:

utilize a first QP value for a Y luminance channel of the color video image for a first macroblock;

utilize a second QP value for at least one of U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, and wherein the relationship

comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock;

apply the first and second QP values; and

compress the color video image, after application of the first and second QP values, to a compressed output image.

40. The computer program of claim 39, further including instructions for causing a computer to decompress the compressed output image using the first and second QP values to obtain an uncompressed video image.

41. A computer program, stored on a computer-readable medium, including instructions operative to cause a computer to:

in a YUV video image compression system, utilize macroblocks and quantization parameters during compression, a variable quantization step size, and a quantization parameter (QP) to represent a size of a step, where an increase in QP corresponds to a larger quantization step size;

select at least one of reducing chroma noise during compression of a color video image and achieve higher compression during compression of the color video image;

in response to selecting reducing chroma noise,

utilize a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilize a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock; and in response to selecting achieving higher compression,

utilize the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilize the second QP value for at least one of the U and V color channels of said first macroblock of the color video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, and wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock.

42. A computer program, stored on a computer-readable medium, including instructions operative to cause a computer to:

in a YUV video image compression system, utilize macroblocks and quantization parameters during compression, a variable quantization step size, and a quantization parameter (QP) to represent a size of a step, where an increase in QP corresponds to a larger quantization step size;

select at least one of reducing chroma noise during compression of a color video image and achieve higher compression during compression of the color video image;

in response to selecting reducing chroma noise,

utilize a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilize a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock; and in response to selecting achieving higher compression,

utilize the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilize the second QP value for at least one of the U and V color channels of said first macroblock of the color video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock, and

wherein for at least one of said relationships, the second QP value is determined by applying a bias value to the first QP value.

43. A computer program, stored on a computer-readable medium, including instructions operative to cause a computer to:

in a YUV video image compression system, utilize macroblocks and quantization parameters during compression, a variable quantization step size, and a quantization parameter (QP) to represent a size of a step, where an increase in QP corresponds to a larger quantization step size;

select at least one of reducing chroma noise during compression of a color video image and achieve higher

compression during compression of the color video image; in response to selecting reducing chroma noise,

utilize a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilize a second QP value for at least one of. a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, and wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock;

in response to selecting achieving higher compression,

utilize the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilize the second QP value for at least one of the U and V color channels of said first macroblock of the color video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, and wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization

resolution than the Y luminance channel for said first macroblock;

apply the first and second QP values; and

compress the color video image, after application of the first and second QP values, to a compressed output image.

44. The computer program of claim 43, further including instructions for causing a computer to decompress the compressed output image using the first and second QP values to obtain an uncompressed video image.

66. A system for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in QP corresponds to a larger quantization step size, including:

means for utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock;

means for utilizing a second QP value for at least one of the U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, wherein the relationship comprises a property that the second QP value is

lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock; and

means for applying the first and second QP values during compression of the color video image.

67. A system for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in QP corresponds to a larger quantization step size, including:

means for utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock;

means for utilizing a second QP value for at least one of the U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, and wherein the relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock, and

wherein for said relationship, the second QP value is determined by applying a bias value to the first QP value; and

means for applying the first and second QP values during compression of the color video image.

68. A system for reducing chroma noise during compression of a color video image in a YUV video image compression system using macroblocks and quantization parameters during compression, utilizing a variable quantization step size and a quantization parameter (QP) to represent a size of a step where an increase in QP corresponds to a larger quantization step size, including:

means for utilizing a first QP value for a Y luminance channel of the color video image for a first macroblock;

means for utilizing a second QP value for at least one of the U and V color channels of the color video image for said first macroblock, wherein said second QP value is dependent only upon a relationship to the first QP value, and wherein the relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock;

means for applying the first and second QP values during compression of the color video image; and

means for compressing the color video image, after application of the first and second QP values, to a compressed output image.

69. The system of claim 68, further including means for decompressing the compressed output image using the first and second QP values to obtain an uncompressed video image.

70. A YUV video image compression system configured to utilize macroblocks and quantization parameters during compression, a variable quantization step size, and a quantization parameter (QP) to represent a size of a step where an increase in QP corresponds to a larger quantization step size, the system including:

means for selecting at least one of reducing chroma noise during compression of a color video image and achieving higher compression during compression of the color video image;

means for, in response to selecting reducing chroma noise,

utilizing a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilizing a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, and wherein the first relationship comprises a property that the

second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock; and

means for, in response to selecting achieving higher compression,

utilizing the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilizing the second QP value for at least one of the U and V color channels of said first macroblock of the color video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, and wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock; and

means for applying the first and second QP values during compression of the color video image.

71. A YUV video image compression system configured to utilize macroblocks and quantization parameters during compression, a variable quantization step size, and a quantization parameter (QP) to represent a size of a step where

an increase in QP corresponds to a larger quantization step size, the system including:

means for selecting at least one of reducing chroma noise during compression of a color video image and achieving higher compression during compression of the color video image;

means for, in response to selecting reducing chroma noise,

utilizing a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilizing a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock; and

means for, in response to selecting achieving higher compression,

utilizing the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilizing the second QP value for at least one of the U and V color channels of said first macroblock of the color video image, wherein for said first macroblock, wherein said second QP

value is dependent only upon a second relationship to the first QP value, wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock, and

wherein for at least one of said relationships, the second QP value is determined by applying a bias value to the first QP value; and

means for applying the first and second QP values during compression of the color video image.

72. A YUV video image compression system configured to utilize macroblocks and quantization parameters during compression, a variable quantization step size, and a quantization parameter (QP) to represent a size of a step where an increase in QP corresponds to a larger quantization step size, the system including:

means for selecting at least one of reducing chroma noise during compression of a color video image and achieving higher compression during compression of the color video image;

means for, in response to selecting reducing chroma noise,

utilizing a first QP value for a Y luminance channel of a first macroblock of the color video image, and

utilizing a second QP value for at least one of a U color channel and a V color channel of said first macroblock of the color video image, wherein said second QP value is dependent only upon a first relationship to the first QP value, and wherein the first relationship comprises a property that the second QP value is lower than the first QP value so that said at least one of the U and V color channels has finer quantization resolution than the Y luminance channel for said first macroblock;

means for, in response to selecting achieving higher

utilizing the first QP value for the Y luminance channel of said first macroblock of the color video image, and

utilizing the second QP value for at least one of the U and V color channels of said first macroblock of the color video image, wherein said second QP value is dependent only upon a second relationship to the first QP value, and wherein the second relationship comprises a property that the second QP value is higher than the first QP value so that said at least one of the U and V color channels has coarser quantization resolution than the Y luminance channel for said first macroblock;

means for applying the first and second QP values during compression of the color video image; and

means for compressing the color video image, after application of the first and second QP values, to a compressed output image.

73. The system of claim 72, further including means for decompressing the compressed output image using the first and second QP values to obtain an uncompressed video.

88. The method of claim 8 or 12, wherein the relationship is defined in a lookup table comprising a plurality of QP values.

89. The computer program of claim 37 or 41, wherein the relationship is defined in a lookup table comprising a plurality of QP values.

90. The system of claim 66 or 70, wherein the relationship is defined in a lookup table comprising a plurality of QP values.

Evidence Appendix

None.

Related Proceedings Appendix

None.